

REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 11 to recite that the micro biochip includes an upper substrate, having a surface, constituting the flow path; consistent therewith, Applicants have cancelled claim 32 without prejudice or disclaimer.

In addition, Applicants have amended each of claims 33 and 34 to recite that the columnar micro pillars, of the group of columnar micro pillars, have an aspect ratio of 4 or more.

Initially, Applicants respectfully note the withdrawal from consideration of claims 33 and 34, as being dependent on withdrawn claims, and respectfully traverse such withdrawal from consideration. Noting that claims 33 and 34 are dependent are withdrawn claims, it is emphasized that claims 33 and 34 are directed to a micro biochip, consistent with the claims being considered on the merits in the above-identified application; and it is respectfully submitted that in view thereof, claims 33 and 34 must be considered on the merits in the above-identified application.

In this regard, attention is respectfully directed to 35 USC 112, fourth paragraph, stating that a claim in dependent form “shall contain a reference to a claim previously set forth and then specify a further limitation of the subject matter claimed”, and that a “claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers”. Thus, it is respectfully submitted that each of claims 33 and 34 recite a micro biochip, incorporating therein the subject matter of their parent claims 27 and 16, respectively. It is respectfully submitted that as claims 16 and 27 remain in the application, albeit withdrawn from

consideration, claims 33 and 34 incorporate therein the subject matter of these withdrawn claims, and must be considered as complete claims, to be considered on the merits with claims directed to the micro biochip in the present claims.

It is respectfully submitted that the foregoing comments constitute a request for reconsideration of the withdrawal from consideration of claims 33 and 34, Applicants respectfully traversing such withdrawal from consideration. In this regard, while Applicants provide the indicator "Withdrawn" for claims 33 and 34, this indicator is set forth within the factual context that the Examiner has withdrawn such claims from consideration. Such indicator does not constitute agreement with, or an admission as to the propriety of, such withdrawal by the Examiner from consideration of claims 33 and 34.

It is respectfully submitted that the present request for reconsideration constitutes any necessary request for reconsideration under 37 CFR 1.181(c), prior to the filing of a Petition under 37 CFR 1.181, if the Examiner maintains the withdrawal of claims 33 and 34 from consideration.

Thus, it is respectfully submitted that the Examiner must consider claims 33 and 34 on the merits; and, as claims 33 and 34 have previously been in the application, it is respectfully submitted that the Examiner must withdraw Finality of the Office Action mailed March 3, 2009, and consider claims 33 and 34 on the merits herein, even as amended by the present amendments.

Furthermore, Applicants respectfully request reconsideration and withdrawal of the Finality of the Office Action mailed March 3, 2009, even if claims 33 and 34 are maintained in a "withdrawn" status. In this regard, the Examiner contends that Finality is proper, in that Applicants' amendments necessitated the new grounds of rejection presented in the Office Action mailed March 3, 2009. Such contention by

the Examiner is respectfully traversed.

Thus, the Examiner has applied Wang, et al. (U.S. Patent Application Publication No. 2003/0119920) as showing an aspect ratio greater than 4. However, it must be emphasized that Applicants' claims recited such aspect ratio of 4 or more prior to the amendments in the Amendment filed December 1, 2008. That is, it is respectfully submitted that Applicants' amendments in the Amendment filed December 1, 2008, did not necessitate application of the new reference to Wang, et al. To the contrary, it is respectfully submitted that the Examiner has applied the teachings of Wang, et al., in connection with features previously in the application, such that application of the teachings of Wang, et al. was not necessitated by Applicants' amendments to the claims.

Accordingly, in view of the failure by the Examiner to previously consider claims 33 and 34, as discussed in the foregoing, the Finality of the Office Action mailed March 3, 2009, must be withdrawn and claims 33 and 34 considered on the merits; and in view of application by the Examiner of new references in connection with features previously in the above-identified application, it is respectfully submitted that Applicants' amendments to the claims in the Amendment filed December 1, 2008, did not necessitate application of new references, and for this reason also Finality of the Office Action mailed March 3, 2009, should be withdrawn. Accordingly, withdrawal of the Finality of the Office Action mailed March 3, 2009, is clearly appropriate.

In any event, it is respectfully requested that the present amendments be entered, even if Finality of the Office Action mailed March 3, 2009m is not withdrawn.

Clearly, noting comments by the Examiner in the second and third paragraphs on page 2 of the Office Action mailed March 3, 2009, present amendments to claim 11,

and cancelling of claim 32 without prejudice or disclaimer, do not raise any new issues, including any issue of new matter, and materially limit issues in connection with the present application, obviating objection to claim 32. Noting previously considered claim 11, clearly amendments to claims 33 and 34 do not raise any new issues, and materially limit remaining issues by providing claims 33 and 34 to be consistent with claim 11, in reciting an aspect ratio of 4 or more. It is respectfully submitted that the present amendments are timely, particularly noting the new references applied by the Examiner in rejecting claims in the Office Action mailed March 3, 2009.

In view of the foregoing, it is respectfully submitted that Applicants have made the necessary showing under 37 CFR 1.116(b); and that, accordingly, entry of the present amendments is clearly proper, even were the Examiner to maintain Finality of the Office Action mailed March 3, 2009.

Applicants respectfully submit that the claims being considered on the merits in the above-identified application patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed March 3, 2009, that is, the teachings of the U.S. patent documents to Austin, et al., Patent No. 6,632,652 (Austin '652), to Austin, et al., Patent No. 5,427,663 (Austin '663), to Wang, et al., Patent Application Publication No. 2003/0119922, to Noca, et al., Patent Application Publication No. 2003/0052006, and to Agrawal, et al., Patent No. 7,159,872, under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that the teachings of these references as applied by the Examiner would have neither disclosed nor would have suggested such a micro biochip as in the present claims, including the group of micro pillars, the micro pillars being provided in a flow path for feeding a sample, with the micro biochip

including an upper substrate, having a surface, constituting the flow path, a tip end of each of the micro pillars being kept in contact with the surface of the upper substrate constituting the flow path, and with equivalent diameters of the micro pillar group being 10 nm through 100 μ m with a height of 0.5 μ m through 500 μ m, and with an aspect ratio of a micro pillar of the micro pillar group being 4 or more. See claim 11.

Note, also, each of claims 33 and 34, each reciting that columnar micro pillars, of the group of columnar micro pillars, have an aspect ratio of 4 or more.

As will be discussed in more detail infra, it is respectfully submitted that the teachings of the prior art applied by the Examiner in connection with, e.g., claim 11 would not have taught such aspect ratio of micro pillars being 4 or more as in the present claims, and advantages achieved thereby.

The Examiner relies on the teachings of Wang, et al., for such aspect ratio. As Wang, et al. discloses a catalyst having a layer of carbon nanotubes, the teachings of this reference would not have been properly combinable with teachings of other applied references, e.g., Austin '652 and Austin '663. And, in any event, Wang, et al. discloses aspect ratios of carbon nanotubes, not of micro pillars; and it is respectfully submitted that the teachings of this reference of Wang, et al., alone or in combination with the teachings of the other applied references, would have neither disclosed nor would have suggested the aspect ratio of micro pillars, as in the present claims, and advantages thereof.

To emphasize, it is respectfully submitted that the teachings of Wang, et al., describing aspect ratio of carbon nanotube catalysts, either alone or in combination with the teachings of the other applied references, would have neither disclosed nor would have suggested an aspect ratio of micro pillars as in the present claims, and advantages thereof.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested the micro biochip as in the present claims, having the recited aspect ratio, and wherein such micro biochip was formed by the process of claim 27 (see claim 33), or by the process of claim 16 (see claim 34).

In addition, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a micro biochip as in the present claims, having features as discussed previously in connection with claim 11, and further including, inter alia, features as in claims dependent on claim 11, such as (but not limited to) wherein the organic polymer is modified on the surface of the micro pillars (see claim 12); and/or wherein the organic polymer contains at least one of antigen, sugar chain and bases (see claim 13); and/or wherein the micro pillar group is a group of micro pillars formed by pressing a mold, having pits, against the material such that the material is pressed into the pits, and separating the mold therefrom, thereby to elongate the columnar micro pillars from the matrix surface (see claim 28), particularly wherein the organic polymer is modified on the surface of the micro pillars (see claim 29); and/or wherein the material of the group of micro pillars includes such an organic polymer that elongates when the mold, having the material of the group of micro pillars therein, is separated therefrom (see claims 30 and 31).

The invention being considered on the merits in the above-identified application is directed to a micro biochip, being equipped with micro pillar groups.

As described on pages 1-3 of Applicants' specification, various types of nano-pillar structure have been proposed, formed by various techniques. For example, a nano-silicon pillar group using a metallic cluster such as iron, gold and silver as a

self-forming nucleus of a plasma etching mask has been proposed. Another technique forms resin-made micro pillars, in which the surface of a silicon substrate is coated with a polymethyl methacrylate film; a mask of a silicon substrate is placed on the film through a spacer; and then heating is performed, in order to form micro pillars on the polymethyl methacrylate film.

However, previously proposed structures involved certain problems. For example, formation of the nano-pillars as described in the foregoing is restricted to inorganic materials, and requires a dry etching method. Moreover, in forming the polymethyl methacrylate micro pillars, it has been difficult to control the position, the diameter and height of the micro pillars freely.

Against this background, Applicants provide structure that can easily and effectively be provided, and which can provide accurate and precise micro pillars made of plastic material and incorporates such micro pillars in a micro biochip to ensure highly sensitive analysis using such micro biochip. Applicants have found that by forming the micro pillars of thermoplastic polymer material, the micro pillars being provided in a flow path (for feeding a sample), the tip end of each of the micro pillars being kept in contact with an upper substrate constituting the flow path, the micro pillars having specified dimensions including an aspect ratio of at least 4, objectives of the present invention are achieved. That is, the sample is prevented from leaking through a gap between the micro pillar group 1000 and upper substrate 1001, and, with the specified structure including aspect ratio of the micro pillars, highly sensitive analysis can be achieved.

In addition, the micro biochip can act as a molecular filter, as described in the last full paragraph on page 31, and the paragraph bridging pages 31 and 32, of Applicants' specification.

Moreover, the micro pillars are made of organic polymer material, thus forming a structure which is relatively inexpensive and which can be formed by an easy and relatively inexpensive method.

Austin '652 discloses an apparatus for sorting microstructures in a fluid medium, the apparatus including a substrate having a floor bound on opposite sides by first and second side walls, the floor and the first and second side walls defining a receptacle; means being positioned within the receptacle for showing the rate of migration of microstructures within the receptacle; and a cover that seals the receptacle and contacts the ends of the means opposite from the floor of the receptacle, being selectively separable therefrom. This patent goes on to disclose that one of the cover or the substrate is comprised of an elastomer, and the other may be comprised of silicon, quartz, sapphire or even an elastomer. See column 7, lines 38-49. Note also Fig. 7 and descriptions in connection therewith from column 9, line 46, through column 10, line 4, disclosing sorting apparatus 80 comprised of an elongated substrate 82 having a correspondingly elongated receptacle 24 located on a side thereof, and an array 86 of obstacles taking the form of bunkers 62 of the type illustrated in Fig. 5, the sorting apparatus being provided with an elastomeric cover 88 that engages tops 66 of each bunker in array 86.

It is respectfully submitted that Austin '652 would have neither disclosed nor would have suggested such micro biochip as in the present claims, including the group of micro pillars, with equivalent diameter of the micro pillar group being 10 nm through 100 μ m with a height of 0.5 μ m through 500 μ m, and an aspect ratio of a micro pillar of the micro pillar group being 4 or more.

It is respectfully submitted that the teachings of the other references applied by the Examiner would not have rectified the deficiencies of Austin '652, such that

the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Austin '663 discloses apparatus and methods for fractionating microstructures such as free cells, viruses, macro molecules, or minute particles, that is, sorting apparatus, the sorting apparatus including a substrate having a shallow receptacle located on a side thereof, the receptacle having first and second ends and a floor bounded on opposite sides by a pair of upstanding opposed side walls extending between the first and second ends of the receptacle, with migration of the microstructures from the first end of the receptacle to the second end of the receptacle defining a migration direction of the receptacle, height of the side walls defining a depth of the receptacle, and this depth being commensurate with the size of the microstructures in the fluid medium. This patent discloses that the array further comprises sifting means positioned within the receptacle intermediate the first and second ends traversing the migration direction, the sifting means being, for example, an array of obstacles provided upstanding from the floor of the receptacle, with the apparatus further including ceiling means positioned over the sifting means for covering the receptacle and for causing migration of the microstructures in essentially a single layer through the sifting means exclusively. See column 5, lines 21-67 of this patent.

As with Austin '652, Austin '663 does not disclose, nor would have suggested, features of the present invention including, inter alia, dimensions of the micro pillars including the aspect ratio of 4 or more, and advantages achieved thereby.

Wang, et al. discloses catalysts containing carbon nanotubes, methods of making catalysts containing carbon nanotubes on porous substrates, systems employing such catalysts and reactions using such catalysts. The catalyst includes

a support material having through-porosity, a layer comprising carbon nanotubes on the support material, and a surface-exposed catalytically-active composition. Note paragraphs [0001], [0008] and [0009] on the first page of this patent document. This patent document goes on to describe, in paragraphs [0043] and [0044] on page 3 thereof, that in some embodiments where through-porosity is not necessary, the support can be a thin membrane of anodized aluminum or other macroporous membrane that is optionally treated with a surfactant template composition such that mesoporous silica substantially fills the macropores, with carbon nanotubes being applied to form a membrane that can be used, for example, as a molecular sieve, an adsorbent, or treated with an ion exchange medium; and that the carbon nanotubes may have a length to width aspect ratio of at least 3, more preferably at least 10, the nanotubes preferably having a length of at least 1 μm , more preferably 5-200 μm , and preferably have a width of 3-100 nm. Note also paragraph [0046] on page 4 of Wang, et al., describing that by "catalyst composition" this patent document is directed to a composition of matter that will catalyze a chemical reaction, preferred embodiments including a catalyst composition that is exposed on at least one surface.

Initially, it is respectfully submitted that the teachings of Wang, et al. would not have been properly combinable with the teachings of the other applied references, including Austin '663 and Austin '652. Thus, note that Wang, et al. is concerned with a catalyst material, while each of the Austin references is directed to sorting/analyzing apparatus. Wang, et al. discloses a catalyst on nanotube materials. It is respectfully submitted that one of ordinary skill in the art concerned with in each of the Austin references, would not have looked to the teachings of Wang, et al. In other words, these references are directed to non-analogous arts.

Furthermore, problems addressed by the present invention, of providing a micro biochip, and problems addressed in, for example, the Austin '652 and '663 references, of providing sorting microstructures, on the one hand; and problems addressed by Wang, et al., that is, in providing catalyst materials on carbon nanotubes, are noted. In view of the different problems involved, it is respectfully submitted that one of ordinary skill in the art involved with in the applied references, or in looking to solve problems addressed by the present invention, would not have looked to the teachings of Wang, et al.

Thus, it is respectfully submitted that absent guidance provided by hindsight use of Applicants' original disclosure, with respect to the aspect ratio described therein, one of ordinary skill in the art concerned with in the Austin references would not have looked to the aspect ratio in Wang, et al. Of course, such hindsight use of Applicants' disclosure is clearly improper under the guidelines of 35 USC 103.

Furthermore, it is respectfully submitted that the Examiner has provided no proper reason for combining the teachings of Wang, et al., with the teachings of the two Austin references. Absent such reason for combining teachings of references, clearly such combination of teachings is improper under the guidelines of 35 USC 103.

In any event, even assuming, arguendo, that the teachings of Wang, et al. were properly combinable with the teachings of the two Austin references, with or without Noca, et al., such combined teachings would have neither disclosed nor would have suggested the presently claimed invention, including the micro pillars having the recited aspect ratio. In this regard, it is again emphasized that Wang, et al. discloses nanotubes having a specific aspect ratio. It is respectfully submitted that such disclosure with respect to nanotubes would have neither disclosed nor

would have suggested micro pillars as in the present invention, having the recited aspect ratio.

Noca, et al. discloses a self-assembled nano-array molecular sieve for the separation of molecules, the apparatus being described most generally in paragraphs [0019] and [0020] on pages 2 and 3 of this patent document. This patent document discloses that, in one embodiment, the self-assembled nano-array sieve includes a substrate having a periodic array of features such that in the presence of an appropriate feed stock the atoms of the feed stock self-assemble on the ordered features of the substrate to produce an ordered array of nano-features having non-random alignment and size distribution, with the size, shape and pattern of self-assembled nano-array features grown on the substrate being adapted such that molecules within a specified size range can be separated. Note also paragraph [0051] on page 6 of this patent document, together with Fig. 5, showing sieve body 44 including a cap layer 66 which makes intimate contact with the array sieve 54.

Even in light of the teachings of Noca, et al., there would have been no reason to combine teachings of Wang, et al. with the teachings of the other references applied therewith.

Moreover, as with Austin '652 and Austin '633, Noca, et al., either alone or in combination with the teachings of the other references applied therewith, would have neither disclosed nor would have suggested the presently claimed subject matter, including the aspect ratio, of micro pillars, with advantages of the present invention in light thereof.

Agrawal, et al., as applied by the Examiner, discloses preparation of substrates having a high surface area for use as a micro array device, including a

plurality of microstructures that may comprise, e.g., a pillar, a cone, a wall, a micro-rod, a tube, a channel or a combination thereof. See column 5, lines 12-22. Note also column 6, line 60, through column 7, line 3, of Agrawal, et al., disclosing that formation of the substrate having a high surface area can include embossing a coating material. Note also, for example, the paragraph bridging columns 4 and 5 of this patent.

Even assuming, arguendo, that the teachings of Agrawal, et al. as applied by the Examiner were properly combinable with the teachings of the other references as applied therewith, such combined teachings would have neither disclosed nor would have suggested such micro biochip as in the present claims, having the group of micro pillars, and wherein an aspect ratio of micro pillars is 4 or more, particularly with equivalent diameter and height of micro pillars as in the present claims.

The contention by the Examiner, with respect to the aspect ratio, in the second full paragraph on page 4 of the Office Action mailed March 3, 2009, is noted. It is emphasized that Wang, et al. discloses carbon nanotubes with active catalyst materials disposed thereon. Such disclosure of Wang, et al. in connection with carbon nanotubes would have neither taught nor would have suggested, either alone or in combination with the teachings of the other applied references, micro pillars as in the presently claimed subject matter, having the recited aspect ratio of 4 or more.

In view of the foregoing comments and amendments, reconsideration and withdrawal of the Finality of the Office Action mailed March 3, 2009, with corresponding entry of the present amendments, with consideration of claims 33 and 34 on the merits, and reconsideration and allowance of all claims then being considered on the merits in the above-identified application, are respectfully requested.

In any event, entry of the present amendments, and reconsideration and allowance of all claims being considered on the merits in the above-identified application, are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (No. 520.43241X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

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